

Predictors of infant positive, negative and self-directed coping during face to face still-face in a Portuguese preterm sample

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Past studies found three types of infant coping behaviour during Face-to-Face Still-Face paradigm (FFSF): a *Positive Other-Directed Coping*; a *Negative Other-Directed Coping* and a *Self-Directed Coping*. In the present study, we investigated whether those types of coping styles are predicted by: infants' physiological responses; maternal representations of their infant's temperament; maternal interactive behaviour in free play; and infant birth and medical status. The sample consisted of 46, healthy, prematurely born infants and their mothers. At one month, infant heart rate was collected in basal. At three months old (corrected age), infant heart-rate was registered during FFSF episodes. Mothers described their infants' temperament using a validated Portuguese temperament scale, at infants three months of corrected age. As well, maternal interactive behaviour was evaluated during a free play situation using CARE-Index. Our findings indicate that positive coping behaviours were correlated with gestational birth weight, heart rate (HR), gestational age, and maternal sensitivity in free play. Gestational age and maternal sensitivity predicted Positive Other-Direct Coping behaviours. Moreover, Positive Other-Direct coping was negatively correlated with HR during Still-Face Episode. Self-directed behaviours were correlated with HR during Still-Face Episode and Recover Episode and with maternal controlling/intrusive behaviour. However, only maternal behaviour predicted Self-directed coping. Early social responses seem to be affected by infants' birth status and by maternal interactive behaviour. Therefore, internal and external factors together contribute to infant ability to cope and to re-engage after stressful social events.

Palavras-chave: Infant coping, Infant physiology, Maternal behaviour.

In a 3-months healthy prematurely born sample, Fuertes, Lopes dos Santos, Beeghly and Tronick (2006, 2009) found different types of infant coping behaviour during Tronick's Face to Face Still-Face Paradigm (FFSF; Tronick, Als, Adamson, Wise, & Brazelton, 1978): a *Positive Other-Directed Coping* that reflects the infants' tendency to elicit social interaction and exhibit positive affect during the FFSF; a *Negative Other-Directed Coping* that reflects the infants' tendency to exhibit negative affect and distancing behaviour during the FFSF; and a *Self-Directed Coping* that reflects the infant's tendency to engage in self-directed coping behaviours during the FFSF. Further studies with full term babies found the same three types of coping behaviour.

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Nevertheless, self-direct coping was less represent in full term sample than in preterm sample (Fuertes, Faria, Barbosa, Justo, Viana, & Gomes-Pedro, in press).

These types of coping were related with future outcomes (Fuertes et al., 2009). Indeed, this study also reports that infants who exhibited more Positive coping behaviour responses during the all FFSF episodes at 3-months were more likely to be classified as secure at 12 months, whereas infants who exhibited more Negative coping responses during the FFSF were more likely to be classified as insecure-resistant, and infants who engaged in more Self-comforting coping behaviours during the FFSF were more likely to be classified as insecure-avoidant. In addition, the differences in infant coping during FFSF and maternal interactive behaviour were retained as significant predictors of attachment status (Fuertes et al., 2009). Therefore, these types of coping may reflect potential emerging regulatory styles associated with specific infant social and emotional development outcomes.

However, is unknown the origins of Positive Other-Directed, Negative Other-Directed and Self-Directed Coping behaviours. In the present study, we investigate whether infant and maternal factors are related and predict those types of coping.

Behavioural differences during FFSF and their relation with social and emotional development

FFSF has been used extensively to investigate infants emotional regulation in response to temporary maternal emotional unavailability and prove to be a reliable window to examine emerging regulatory abilities after infant's 2-months age (Adamson & Frick, 2003). Typically, infants emit less positive affect and display more negative arousal or self-comforting behaviours during maternal Still-Face (Cohn & Tronick, 1987, 1989; Gianino & Tronick, 1988; Mayes & Carter, 1990; Toda & Fogel, 1993; Tronick et al., 1978; Weinberg & Tronick, 1996). Furthermore, infants exhibit a carry-over of negative affect from the still-face to the re-engagement episode named *still-face effect* (Weinberg, Tronick, Cohn, & Oslon, 1999).

Although, there is a normative response, infants differ on their attempt to self-regulate during FSFF. For instance, compared to infants who exhibit more positive coping behaviours during Still-Face, infants with higher levels of negative arousal and self-comforting behaviours have more difficulty in recovering during the reunion episode (Weinberg et al., 1999). Some studies found that those differences in self-regulatory behaviour in FFSF were related with future outcomes. For example, beside Fuertes et al. (*op. cit.*), Braungart-Rieker, Garwood, Powers and Wang (2001) reported that 4-months infants who exhibited lower arousal (i.e., less crying) during the FFSF were more likely to be classified as B1 or B2, or as insecurely-avoidant attached. In opposite sense, B3 or B4 patterns of secure attachment and insecure-resistant style were associated with a higher expression of distress. Similar, other investigators had reported that securely attached infant differ from avoidant-insecurely attached in discrete behaviours observed during the FFSF, such as infant gaze, self-touch or facial expressions (Cohn, Campbell, & Ross, 1991; Koulomzin, Beebe, Anderson, Jaf Feldstein, & Crown, 2002).

Factors associated with infant behavioural differences during FFSF

Many studies found that infant ability to react during FFSF is related with physiological and social factors. For instance, some examined the physiological regulation of emotions across FSFF episodes. Stoller and Field (1982) found in full term infant that higher level of smiling was related to the decrease of HR in Still-Face, whereas gaze aversion, crying and negative facial expression were related with HR increasing (Field, 1981). Others reported that infants who increase their HR during Still-Face episode showed less positive affect and higher physical reactivity during normal interactions with their mothers (Moore & Calkins, 2004).

Some examined the relation between infant behaviour during FFSF and maternal reports of their infant temperament. In a low-risk sample, mothers ratings of infant's difficult temperament were inversely associated with self-comforting behaviour (Barbosa & Fuertes, 2010; Braungart-Rieker et al., 1998). However, these ratings were not corroborated by independent coders. Another study reveals that mothers with disengaged or distorted representations had infants who demonstrated less positive affect during the SF and re-engagement (Rosenblum, McDonough, Muzik, Miller, & Sameroff, 2002). However, the literature is inconclusive regarding the impact of maternal representations on infant behaviour during FFSF since some other studies did not report any significant relation (Cohn et al., 1991; Fuertes, Faria, Fink, & Barbosa, 2011; Tarabulsky et al., 2003).

Moreover, others studied the external input for infant self regulation. From all factors, maternal behaviour such as affect, responsiveness and sensitivity is the most related to infant behaviour during FFSF in several studies (e.g., Haley & Stansbury, 2003). Tronick, Ricks and Cohn (1982) found that maternal sensitivity to infants' cues was related to infant positive responses during Still-Face episode. Later, Kogan and Carter (1996) reported that infants of less sensitive mothers exhibited higher avoidance and resistance in reengagement. Maternal behaviour evaluated outside the FFSF has been also related with infant responses during FFSF. Indeed, parent's positive affect during normal play was associated with the infant's social gaze during FFSF (Carter, Mayes, & Pager, 1990) and lower levels of negative affect (Braungart-Rieker, Garwood, Powers, & Notaro, 1998).

Current study. We investigate the association between infant behavioural variability under and after a social stress and a set of infant and maternal factors including: infant birth and medical status; maternal and family demographics; maternal representations' of infant temperament; infant physiological responses; and mother interactive behaviour in free play. Moreover, we will explore independent predictors of infant coping by using multiple regression analyses. Based on findings from prior research, we expected that multiple factors would be associated with positive coping behaviour including: lower infant medical or social risk status (e.g., higher birth weight, higher maternal education); lower maternal ratings of their infants difficult temperament; lower arousal (behavioural and HR) during Still-Face and Re-engagement episodes of FFSF paradigm, and higher maternal sensitivity during free play. Moreover, we expect to observed still-face effect.

Since, past studies found that three coping patterns were proportional distributed in prematurely born infants (Fuertes et al., in press), we select this sample to maximize the potential predictive value of each factor by likely increasing the number of cases in each stile of coping.

METHOD

Participants

Participants were 46 healthy prematurely born infants and their healthy, adult mothers (M age=29.7 years; SD =5.7; range: 18-42). The infants birth weight ranged from 1100 to 2500 grams (M =2095, SD =.47) and their gestational ranged from 31 to 36 weeks (M =33.9 weeks, SD =1.73). Five minute Apgar scores ranged from 7 to 10 (M =9.24; SD =.88).

Mother-infant dyads were recruited in the Neonatal Unit Care of Matosinhos Hospital, Portugal. More descriptive statistics are provided in Table 1.

The participants were primarily Portuguese Caucasian from middle-class, urban backgrounds. All infants were healthy and clinically normal at delivery as determined by paediatric examination. No infants had sensory or neuromotor disabilities, serious illnesses, or congenital anomalies. No

parents had any known mental health or drug/alcohol addiction problems. All infants lived with both parents in the same household (six couples were unmarried).

TABLE 1
Infant and maternal characteristics

	<i>N (%)</i>
Infant gender	
Female	18 (39.14%)
Male	28 (60.86%)
Birth order	
First born	32 (69.57%)
Second born	13 (28.26%)
Later born	1 (2.17%)
Maternal delivery method	
Vaginal	13 (28.26%)
Caesarean section	33 (71.74%)
Socio-economic status	
Lower middle class	21 (45.65%)
Middle class	16 (34.78%)
Upper middle class	9 (19.57%)
Maternal years of education	
Up to 4 years (first grade of basic school)	9 (19.57%)
5 to 6 years (second grade of basic school)	7 (15.22%)
7 to 9 years (third grade of basic school)	12 (26.09%)
10 to 12 years (secondary school level)	5 (10.87%)
More than 12 years (completed a College/University degree)	13 (28.26%)

Compared to other samples collected in Western countries, in our study maternal formal education was quite low. Nevertheless, according to the last national census, the sample values are roughly similar to Portuguese indices for women education (INE, 2004).

Procedure

A female research assistant contacted personally potential participant mothers at the Neonatal Care Unit and explained the study's purpose and procedures. To determine eligibility, mothers were administered a brief interview to collect demographic information. With the mother's consent, information from the infant's hospital medical record was obtained regarding his or her perinatal health condition. The study aims and procedures were approved by the Ethics Commission and People Rights Protection of the Portuguese Health Unit of Matosinhos Hospital.

Measures

Medical and familial demographic information. Medical and demographic measures included delivery method, infant Apgar score, gestational age, birth weight, sex, parity, family socio-economic status, mother age, and maternal years of completed education.

Heart rate monitoring. While infant laid on medical table (next to mother), the researcher with help from a technician assistant placed three disposable Pediatric electrodes in an inverted triangle

pattern on the infant chest. The electrodes were connected to a Holter (12-lead ECG Recorder/2.5 microvolts/0.05 a 60 HZ) where R-waves were registered. By using Mortara H-Scribe program, the ECG signal was then digitized by computer and reconverted into inter-beat interval values measured in milliseconds. Sequential inter-beat interval values were used to calculate HR values.

During FFSF the infant was placed in a baby seat and HR was collected during each episode.

Maternal ratings of infant temperament. Mothers described their infants' temperament using the Escala do Temperamento do Beb  (Lopes dos Santos, Fuertes, & Sanches-Ferreira, 2005). Mothers were asked to rate nine aspects of their infant's current behaviour using a 7-point Lickert scale. This scale was previously tested in a sample of 127 healthy infants (60 preterms and 67 full-terms). Items were factor analyzed yielding a single factor ("Difficult Behaviour") that explained 65.4% of the total variance. Alpha coefficient for estimate reabilit e was .933 and test-retest correlation was $r=.793$. Validity of the scale was also successfully checked against other Portuguese validated measures of Infants' Difficult Behaviour.

Maternal interactive behaviour. Before the FFSF took place, mothers were videotaped in free play with their infants. Following the instructions in the CARE-Index manual, each dyad was filmed for about three minutes (between two and five minutes). The mothers were asked was instructed to play with the infant as she typically would at home. A standard set of toys was provided for the dyad, arranged on a blanket on the floor of the play room. The CARE-Index assesses three dimensions of mother's interactive behaviour with the infant (Sensitive, Controlling/Intrusive, and Unresponsive), and four dimensions of the infant's interactive behaviour with the mother (Cooperative, Compulsive-Compliant, Difficult, and Passive).

The results were scored by a trained and reliable coder using the CARE-Index (Crittenden, 2003). Other trained and blind observer scored 16 cases selected randomly. The mean Cohen's kappa coefficient for inter-rater agreement was for: maternal sensitivity=.95; maternal control/intrusiveness=.91; maternal unresponsivity=.84. The total mean of Kappa's from maternal scales is .90.

Infant regulatory (coping) behaviour. Infants' ability to regulate stress at 3-months was evaluated during an adapted version of Tronick's Face-to-Face Still-Face paradigm (FFSF; Tronick et al., 1978). Mother-infant dyads were videotaped during three successive 3-minute episodes: a normal face-to-face interaction, in which the mother was instructed to play with the infant as she typically would at home, followed by a 3-minute episode in which the mother was instructed to look at the baby while keeping a still (neutral) face and to refrain from talking, smiling, or touching the baby, followed by a second 3-minute normal reunion interaction, in which the mother was instructed to return to a normal play with the infant. The laboratory room was equipped with an infant seat mounted on a table, an adjustable chair for the mother, and two cameras (with microphones). One camera filmed the baby and the other one filmed the mother. Both picture signals were transmitted through a split-screen generator into a single camera to obtain simultaneous frontal views of the mother and the infant. The video recorder and the split-screen generator were located in an adjoining equipment room.

Coding of infant behaviour during FFSF. The infants' regulatory behaviour (coping) during the 3 episodes of FSFF was scored micro-analytically second-by-second from videotapes by a trained coder using the IRSS: Infant Regulatory Scoring System (Tronick & Weinberg, 1990). Following this scoring, individual behaviours were grouped into three *a priori* summary categories according to Fuertes et al. (2009, in press) system. *Positive Other-Directed Coping* reflects the infants' tendency to elicit social interaction and exhibit positive affect during the FFSF (i.e., infant looks at the mother's face, looks at the mother's body, reaches toward or touches the adult, makes

positive vocalizations, or smiles); *Negative Other-Directed Coping* reflects the infants' tendency to exhibit negative affect and distancing behaviour during the FFSF (i.e., makes protest vocalizations, cries, arches or pushes away from the mother, or attempts to escape from the mother by turning away from the mother); and *Self-Directed Coping* reflects the infant's tendency to engage in self-directed coping behaviours during the FFSF (i.e., infant mouths his or her hands, mouths objects, closes his or her eyes, looks away from the mother, self touches, squeezes one hand against the other).

The score on each dimension was not a simple addition of the frequency of the behaviours, but was weighted to index to the extent to which different behaviours in the dimension co-occurred. One behaviour in a dimension was scored as a 1, two behaviours performed together were scored as 3, and 3 or more behaviours occurring together received 5 points (more than 3 behaviours were a rare situation). Therefore, the range by each second is 0 to 5 points. The values were scored by each 10-second intervals over the 3 episodes of FFSF. This weighted system allows us to assess the relative degree of infants' responses in a given dimension. For example, a simultaneously smiling, looking at mother and trying to reach her is considered a more positive reaction in the Positive Other-Directed dimension than merely looking at mother.

The means of infant Positive Other-Directed, Negative Other-Directed and Self-Directed Coping behaviours by episode and overall were computed.

Reliability. To evaluate inter-coder reliability, an independent and blind coder scored 15 randomly selected videotapes (30.6% of the sample). The mean Cohen's kappa coefficient for inter-rater agreement was 0.87. To evaluate intra-observer reliability (coder drift), 15 randomly selected cases were scored again by the first coder after a six month interval (Kappa=0.89).

Analytic plan

Three sets of statistical analyses were carried out to address the goals of this study. First, using bivariate analyses differences in Infants' Coping Behaviour and HR (Heart Rate) were evaluated among the three Face to Face Still Face episodes. Second, the correlation association between Infants' Coping Behaviour (Positive Other-Directed Coping, Negative Other-Directed, Self-Directed Coping) and each potential predictor variable was evaluated. The potential predictor variables included birthweight, gestational age, infant gender, maternal age, maternal education, SES, maternal representations of the infants' difficult temperament, HR mean in basal (at 1 and 3 months), HR mean during FSFF episodes, and the three rated dimensions of mothers' interactive behaviour observed during play at the 3-month visit. Alpha was set at .05. Third, the independent contributions of infant, maternal, and demographic variables to infant regulatory behaviour during FSFF were evaluated using multiple regression analyses. Only variables identified as being significantly associated with Infant Coping Behaviour in the correlational analyses were evaluated as potential predictors in these regressions.

RESULTS

Infant behavioural variability across FFSF episodes

The Still-Face Effect was observed in our study as described by other studies (results in Table 2). Indeed, the infant positive responses significantly decrease whereas negative responses, self-comfort and HR significantly increased during Still-Face episode.

TABLE 2

Means and standard deviations for summary measures of infants' coping behaviour scored each 10 seconds during FFSF and infants' physiological responses during the FFSF at 3 months

Variables	First episode		Still-face		Re-engagement		<i>F</i> (2,44)	<i>P</i> <
	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)		
Positive other-directed coping	7.26	(3.31)	2.72	(1.43)	5.86	(2.89)	36.30**	.001
Negative other-directed coping	0.95	(0.12)	6.25	(1.84)	2.19	(1.76)	38.68**	.001
Self-directed coping	2.12	(0.76)	4.90	(1.35)	3.58	(2.59)	32.78*	.01
Heart-rate	124,57	(15.85)	170,55	(18.15)	149,43	(11.23)	129,82**	.001

Note. **.001; **p*<.01; *p* values corrected according to Bonferroni confidence interval adjustment.

Correlations between infants' coping styles and demographic, infant physiological, temperament and maternal variables

Using Pearson method, the total scores of the infant Positive Other-Directed, Negative Other-Directed, and the Self-Directed behaviours in the three episodes FSFF were correlated with a set of factors (see Table 3). We present a single measure using the three episodes for the infant coping styles since no significant relation was found by episode.

TABLE 3

Pearson correlations between demographic, infant physiological, temperament and maternal variables, and scores of infants' coping behaviour during FFSF

	Positive other-directed coping	Negative other-directed coping	Self-directed coping
Positive other-directed coping	1	.064	-.038
Negative other-directed coping	-	1	-.316*
Self-directed coping	-	-	1
Gestational age	.304*	-.091	-.006
Gestational weight	.385**	-.019	.075
Maternal education	-.149	-.187	.179
HR mean at 1 month in basal	-.129	-.138	-.114
HR mean at 3 months in basal (FSFF first episode)	.044	-.148	.058
HR mean at 3 months during still-face	-.314*	-.262	.347**
HR mean at 3 months after still-face (recovery episode)	-.041	-.253	.340*
Maternal representation of infants difficult temperament at 3 months	-.210	.235	.033
Maternal sensitivity at 3 months	.321*	-.123	-.249
Maternal control at 3 months	-.179	-.056	.308*
Maternal unresponsivity at 3 months	-.134	.245	-.183

Note. ***p*<.01; **p*<.05.

The findings indicate that Positive Other-Directed style of coping was positively correlated with infant gestational age, infant gestational birth-weight and maternal sensitive behaviour. This behavioural style was negatively correlated with infant increasing of HR during Still-Face episode. In turn, the Self-Directed style of coping was positively correlated with infant HR increasing during and after SF and with maternal controlling/intrusive behaviour.

Using means *t* test, infants gender and birth order differences for infant coping behaviour were explore and no significant differences were found.

Multiple regression analyses results

Multinomial regression was used to test for independent predictors of infant coping styles. For that purpose, the means of infant Positive Other-Directed Coping, the Negative Other-Directed Coping and the Self-Directed Coping for all three episodes of FFSF was computed.

The default method for multiple regression method was used. Therefore, all possible predictors of coping styles were tested at once namely: gestational age, gestational weight, infant gender, infant heart rate across FSFF episodes, maternal representation of infant difficult temperament and maternal interactive behaviour. Independent regressions were performed for Positive Other-Direct and Self-Directed Coping (Table 4).

TABLE 4
*Results of multiple regressions predicting positive other-directed coping
and self-directed coping at 3 months*

Regression model predicting coping style	R-Square	<i>F</i> (<i>df</i>)	Significance level
Positive other-directed coping:			
1. Gestational age	.169	7.299 (1)	<i>p</i> <0.01
2. Maternal sensitivity	.278	6.741 (2)	<i>p</i> <0.003
Self-directed coping:			
Maternal control	.171	7.427 (1)	<i>p</i> <0.01

DISCUSSION

Since priori studies performed with prematurely born infant found that types of coping behaviour predict attachment status (Braungart-Rieker, Garwood, Powers, & Wang, 2001; Fuertes et al., 2006, 2009), we investigate the predictive impact of a set of infant, maternal and demographic factors on Positive Other-Directed, Negative Other-Directed and Self-Directed Coping behaviour.

First, our findings corroborate an extensive literature that describes the *Still-Face Effect* (e.g., Cohn & Tronick, 1987, 1989; Gianino & Tronick, 1988; Mayes & Carter, 1990; Toda & Fogel, 1993; Tronick et al., 1978; Weinberg & Tronick, 1996). Thus, infants increased the negative affect, dropped positive affect and social attend, and increase autonomic arousal (heart-rate) during Still-Face episode.

Our results obtained in this Portuguese prematurely born sample indicate that neonatal status plays an important role on coping. In fact, infants born with high gestational age and birth weight are more likely to present positive coping behaviours. Further studies, may explore the differences between infants born at term and prematurely born, in order to investigate the relevance of neonatal status on infants coping with stressful situations. Moreover, our results indicate that maternal behaviour in free play is associated with infant type of coping. Maternal sensitivity was positively correlated with Positive Other-Directed coping behaviour and maternal control is correlated with Self-Directed behaviours. Furthermore, gestational age predict infant Positive Other-Direct coping.

Infant heart rate variability was correlated with Positive Other-Directed coping behaviour and Self-Directed behaviours during and after maternal Still-Face. Therefore, we speculate that infant behavioural responses may reflect internal physiological states.

We speculate that neonatal birth conditions (e.g., gestational age and birth weight) may affect the infant initial and internal reactivity while mothers interactive behaviour probably provide the necessary interactive support to promote infant self-regulate and sooth competences (Beeghly, Fuertes, Liu, Delonis, & Tronick, 2010).

Fuertes et al. (2009) found that at 3-months infant coping predict patterns of attachment at 12 months. In our study at 3-months, both infant Positive Other-Direct coping and Self-Direct coping were predicted by specific maternal types of interactive behaviour. These findings suggest that maternal sensitivity enhances infant regulatory behaviour. In turn, infants contribute with their positive, negative or self-direct behaviours to the dyadic states. Such reasoning supports a transactional approach of mother-infant interaction (Sameroff & Fiese, 2000). Over time, both partners may improve their expectations about each other behaviour and adjust their social performance so that the dyad patterns of behaviour become more coherent and organized. Therefore, more longitudinal research is needed to assess the continuity and change in coping styles and their interdependence with maternal responses.

An intriguing result is the absence of relation between the category of Negative Other-Directed behaviours and the other factors investigated in this study. It is not clear why infant negative responses are not related with other factors including maternal interactive behaviour or heart rate variations during FFSF. Nevertheless, we speculate that many infants may need to express their discomfort using negative behaviours without necessarily being persistently negative. However, we believe that to exhibit a profusely positive behaviour (Positive Other-Directed coping) or to be able self-comfort (Self-Direct coping) it may require a higher solicitude of internal states.

Our results indicate that Self-Direct coping behaviour is independent from infant birth status. It seems that this Self-Direct coping is more related with maternal intrusivity and over control than from neonatal status. Since past studies found that infant Self Coping Style predicts insecure-avoidant attachment (Fuertes et al., 2009), we speculate that this type of arousal regulation it is an early protective strategy that may lead to a defensive and avoidant behaviour.

Several limitations of our study must be acknowledged. The relatively small sample size prevented us from evaluating potential indirect as well as direct effects on infants' coping behaviour. Future research is need with large samples in order to better understand the predictors and mediator variables of infants' coping behaviour. Longitudinal studies may also contribute to explore the presence of other factors that may affect the coping trajectories and to understand the coping contribution to the infant development.

Nevertheless, this study indicates that infant coping in FFSF is associated with birth status (gestational age and gestational weight) and maternal behaviour (maternal sensitivity and control). Of course, both factors (birth status and maternal behaviour) are related and interdependent. From a transactional point of view, the fact that most prematurely born infant are less alert, less attentive and less responsive (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983; Goldberg & DiVitto, 1995) affect mothers behaviour that in turn, are more anxious and intrusive (Barnard & Kelly 1990; Forcada-Guex, Borghini, Moessinger, & Muller-Nix, 2006; Goldberg & DiVitto 1995; Muller-Nix, Forcada-Guex, Pierrehumbert, Jaunin, Borghini, & Ansermet, 2004). To better understand the premature birth impact on infant socio-emotional development, future comparative studies with full term infants are necessary to explore the significance of the premature birth on infant coping.

Nonetheless, this study raises an important question: Can individual differences in coping only be explained by internal factors (e.g., physiological regulation) or may external factors like maternal responsiveness contribute to the infant's self-regulation during and after stressful events?

The infants ability to self-regulate and to reengage after a stressful interaction may contribute to their social and emotional development (Calkins & Fox, 2002; Moore, Cohn, & Campbell, 2001; Weinberg & Tronick, 1996). Regulatory processes begin to develop prenatally and rapidly evolve into a more sophisticated organization over the course of life-span (Sameroff, 1995; Sroufe, 1996). Our results corroborate previous findings that suggest that self-regulation depends on internal, external and mutual dyadic factors (Carter, Mayes, & Pajer, 1990; Cohn, Campbell, & Ross, 1991; Feldman, 2007; Thompson, 1994; Tronick, Ricks, & Cohn, 1982). As predict by Tronick's Dyadic States of Consciousness Model (Tronick, 2005), both infant and parents contributes for the dyadic regulation. Both contributes depend on the experience lived in any ongoing interaction and also on the experience acquired in past social interactions.

REFERENCES

- Adamson, L. B., & Frick, J. E. (2003). The still face: A history of a shared experimental paradigm. *Infancy*, 4(4), 451-473.
- Barbosa, M., & Fuertes, M. (2010). *Attachment and maternal representations in prematurely born*. *Infant Mental Health Journal*, 32 (supplement), 3, 188-189.
- Barnard, K. E., & Kelly, J. F. (1990). Assessment of parent-child interaction. In S. J. Meisels & J. P. Shonkoff (Eds.), *Handbook of early childhood intervention* (pp. 278-302). New York: Cambridge University.
- Beeghly, M. Fuertes, M., Liu, C., Delonis, M. S., & Tronick, E. (2010). Maternal sensitivity in dyadic context: Mutual regulation, meaning-making, and reparation. In Deborah Winders Davis & M. Cynthia Logsdon (Eds.), *Maternal sensitivity: A scientific foundation for practice* (pp. 59-83). New York: Nova Science Publishers.
- Braungart-Rieker, J., Garwood, M. M., Powers, B. P., & Notaro, P. C. (1998). Infant affect and affect regulation during the still-face paradigm with mothers and fathers: The role of infant characteristics and parental sensitivity. *Developmental Psychology*, 34(6), 1428-1437.
- Braungart-Rieker, J. M., Garwood, M. M., Powers, B. P., & Wang, X. (2001). Parental sensitivity, infant affect, and affect regulation: Predictors of later attachment. *Child Development*, 72(1), 252-270.
- Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology*, 14(3), 477-498.
- Carter, A. S., Mayes, L. C., & Pajer, K. A. (1990). The role of dyadic affect in play and infant sex in predicting infant response to the still-face situation. *Child Development*, 61(3), 764-773.
- Cohn, J. F., & Tronick, E. Z. (1987). Mother infant face-to-face interaction – The sequence of dyadic states at 3,6, and 9 months. *Developmental Psychology*, 23(1), 68-77.
- Cohn, J. F., & Tronick, E. (1989). Specificity of infants' response to mothers affective behavior. *Journal of the American Academy of Child and Adolescent Psychiatry*, 28(2), 242-248.
- Cohn, J. F., Campbell, S. B., & Ross, S. (1991). Infant responses in the still-face paradigm at 6 months predicts avoidant and secure attachment at 12 months. *Development and Psychopathology*, 3, 367-376.
- Crittenden, P. M. (2003). *CARE-Index manual*. Unpublished manuscript, Miami: Family Relations Institute.
- Crnic, K., Ragozin, S., Greenberg, M., Robinson, M., & Basham, R. (1983). Social interaction and development competence of preterm and full-term during the first year of life. *Child Development*, 54, 1199-1210.

- Feldman, R. (2007). Parent-infant synchrony: Biological foundations and developmental outcomes. *Current Directions in Psychological Science*, 16(6), 340-345.
- Field, T. M. (1981). Infant gaze aversion and heart-rate during face-to-face interactions. *Infant Behavior & Development*, 4(3), 307-315.
- Forcada-Guex, M., Pierrehumbert, B., Borghini, A., Moessinger, A., & Muller-Nix, C. (2006). Early dyadic patterns of mother-infant interactions and outcomes of prematurity at 18 months. *Pediatrics*, 118(1), 107-114.
- Fuertes, M., Faria, A., Fink, N. & Barbosa, M. (2011). Associations among maternal representation at birth and attachment in Portuguese dyads with preterm and full term infant. *International Journal of Development and Educational Psychology*, 1, 76-86.
- Fuertes, M., Lopes dos Santos, P., Beeghly, M., & Tronick, E. (2006). More than maternal sensitivity shapes attachment: Infant coping and temperament. *Annals New York Academy of Sciences*, 1094 (Resilience in Children), 292-296.
- Fuertes, M., Lopes-dos-Santos, P., Beeghly, M., & Tronick, E. (2009). Infant coping and maternal interactive behavior predict attachment in a Portuguese sample of healthy preterm infants. *European Psychologist*, 14(4), 320-331.
- Fuertes, M., Faria, A., Barbosa, M. Justo, J. Viana, L. & Gomes Pedro, J. (in press). Neuropsicologia do comportamento social de bebés nascidos pré-termo e de termo e impacto do comportamento materno.
- Gianino, A., & Tronick, E. Z. (1988). The mutual regulation model: The infant's self and interactive regulation coping and defense. In Field (Ed.), *Stress and coping* (pp. 47-68). Hillsdale, NJ.: Erlbaum.
- Goldberg, S., & DiVitto, B. (1995). Parenting children born preterm. In M. Bronstein (Ed.), *Handbook of parenting* (vol. I, pp. 209-231).
- Haley, D. W., & Stansbury, K. (2003). Infant stress and parent responsiveness: Regulation of physiology and behavior during still-face and reunion. *Child Development*, 74(5), 1534-1546.
- INE. (2004). *Estatísticas demográficas*. Lisboa: Instituto Nacional de Estatística.
- Kogan, N., & Carter, A. S. (1996) Mother-infant reengagement following the still-face: The role of maternal emotional availability in infant affect regulation. *Infant Behavior and Development*, 19, 359-370.
- Koulomzin, M., Beebe, B., Anderson, S., Jaffe, J., Feldstein, S., & Crown, C. (2002). Infant gaze, head, face and self-touch at 4 months differentiate secure vs. avoidant attachment at 1 year: A microanalytic approach. *Attachment and Human Development*, 4(1), 3-24.
- Lopes dos Santos, P., Fuertes, M., & Sanches-Ferreira, M. (2005). A percepção materna dos atributos temperamentais do bebé: Características psicométricas de um questionário e seu valor prognóstico relativamente à qualidade da vinculação. In J. Bairrão (Ed.), *Desenvolvimento: Contextos familiares e educativos* (pp. 142-170). Porto: Livpsic.
- Mayes, L. C., & Carter, A. S. (1990). Emerging social regulatory capacities as seen in the still-face situation. *Child Development*, 61(3), 754-763.
- Moore, G. A., & Calkins, S. D. (2004). Infants' vagal regulation in the still-face paradigm is related to dyadic coordination of mother-infant interaction. *Developmental Psychology*, 40(6), 1068-1080.
- Moore, G. A., Cohn, J. F., & Campbell, S. B. (2001). Infant affective responses to mother's still face at 6 months differentially predict externalizing and internalizing behaviors at 18 months. *Developmental Psychology*, 37(5), 706-714.
- Muller-Nix, C., Forcada-Guex, M., Pierrehumbert, B., Jaunin, L., Borghini, A., & Ansermet, F. (2004). Prematurity, maternal stress and mother-child interactions. *Early Human Development*, 79, 145-158.

- Rosenblum, K. L., McDonough, S., Muzik, M., Miller, A., & Sameroff, A. (2002). Maternal representations of the infant: Associations with infant response to the still face. *Child Development*, 73(4), 999-1015.
- Sameroff, A. (1995). General systems theories and developmental psychopathology. In Cohen (Ed.), *Developmental Psychopathology* (vol. 1: Theory and methods, pp. 659-695). New York: Wiley.
- Sameroff, A., & Fiese, B. (2000). Transactional regulation: The developmental ecology of early intervention. In J. Shonkoff & S. Meisels (Eds.), *Handbook of early childhood intervention* (pp. 135-159). Cambridge: Cambridge University Press.
- Sroufe, L. A. (1996). *Emotional development: The organization of emotional life in the early years*. Cambridge: Cambridge Studies in Social and Emotional World.
- Stoller, S. A., & Field, T. (1982). Alteration of mother and infant behavior and heart rate during a still-face perturbation of face to face interaction. In Field (Ed.), *Emotions and early interaction* (pp. 57-82). Hillsdale, NJ: Erlbaum.
- Tarabulsky, G. M., Provost, M. A., Deslandes, J., St-Laurent, D., Moss, E., Lemelin, J. P., Bernier, A., & Dassylva, J. F. (2003). Individual differences in infant still-face response at 6 months. *Infant Behavior & Development*, 26(3), 421-438.
- Thompson, R. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development*, 59(2-3, Serial n° 240), 25-52.
- Toda, S., & Fogel, A. (1993). Infant response to the still-face situation at 3 and 6 months. *Developmental Psychology*, 29(3), 532-538.
- Tronick, E. Z. (2005). Why is connection with others so critical? The formation of dyadic states of consciousness and the expansion of individuals' states of consciousness: Coherence governed selection and the co-creation of meaning out of messy meaning making. In Muir (Ed.), *Emotional development: Recent research advances*. Oxford: Oxford University Press.
- Tronick, E. Z., & Weinberg, M. K. (1990). *The infant regulatory scoring system (IRSS)*. Unpublished manuscript, Boston: Children's Hospital & Harvard Medical School.
- Tronick, E. Z., Ricks, M., & Cohn, J. F. (1982). Maternal and infant affective exchange: Patterns of adaptation. In Fogel (Ed.), *Emotion and early interaction* (pp. 83-100). Hillsdale, NJ: Erlbaum.
- Tronick, E., Als, H., Adamson, L., Wise, S., & Brazelton, T. B. (1978). Infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child and Adolescent Psychiatry*, 17(1), 1-13.
- Weinberg, M. K., & Tronick, E. Z. (1996). Infant affective reactions to the resumption of maternal interaction after the still-face. *Child Development*, 67(3), 905-914.
- Weinberg, M. K., Tronick, E. Z., Cohn, J. F., & Oslon, K. L. (1999). Gender differences in emotional expressivity and self-regulation during early infancy. *Developmental Psychology*, 35(1), 175-188.

Estudos anteriores encontraram três estilos de *coping* expressos no decorrer da experiência Face-to-Face Still-Face (FFSF): *Orientação Social Positiva*; *Orientação Social Negativa* e *Regulação do Estado*. No presente estudo longitudinal investiga-se se estes estilos predizem: a variação cardíaca nos bebês; as representações maternas do temperamento infantil; comportamento materno em jogo livre; e estatuto de saúde e de nascimento dos bebês. A amostra era constituída por 46 bebês saudáveis nascidos de pré-termo e suas mães. No primeiro mês (idade corrigida), o ritmo cardíaco dos bebês foi observado em basal. Aos três meses (idade corrigida), o ritmo cardíaco dos bebês foi registado durante os episódios do FFSF e as representações das maternas do temperamento dos filhos recolhidas através de uma escala validada na população Portuguesa. Igualmente aos 3 meses, o comportamento materno em jogo livre foi observado e cotado com a escala Care-Index. Os nossos resultados indicam que os

comportamentos sociais positivos estão correlacionados com o peso gestacional, idade gestacional, ritmo cardíaco (RC), e sensibilidade materna. Destas, a idade gestacional e a sensibilidade maternal predizem o comportamento social positivo. Este comportamento também esteve negativamente correlacionado com o RC durante o episódio de Still-Face. O comportamento de Regulação do Estado esteve correlacionado com o RC durante os episódios de Still-Face Episode e de Reunião bem como o comportamento materno controlador/intrusivo. No entanto, apenas, o comportamento materno prediz o comportamento de auto-conforto. Em suma, as primeiras respostas sociais parecem ser afectadas pelo estatuto de nascimento do bebé e pelo comportamento materno. Consequentemente, os factores endógenos e exógenos juntos parecem contribuir para auto-regulação infantil durante e após períodos perturbadores de interacção social.

Palavras-chave: Comportamento materno, Coping infantil, Fisiologia infantil.

